

Appl. Serial No.: 10/718,511
Amendment dated December 28, 2004
Reply to Office action of November 5, 2004

AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

1. (Original) A flow rate sensor for detecting a flow rate of a fluid, said flow rate sensor comprising:
 - a sensor tube operable to allow a fluid to flow therein;
 - a sensor tube guide adapted to cover said sensor tube and contact said sensor tube;
 - a plurality of narrow inner tubes provided within said sensor tube;
 - a pair of heating resistors operable to heat said sensor tube, said pair of heating resistors provided on said sensor tube guide;
 - a temperature sensor operable to control temperatures of said pair of heating resistors, said temperature sensor being positioned equidistant from opposite ends of said sensor tube;
 - a case adapted to hold said pair of heating resistors and said temperature sensor;
 - and
 - a voltage applying device operable to set an increase in temperature of each of said pair of heating resistors;
 - wherein said sensor tube has opposite ends thereof thermally connected to said case; and

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wherein said flow rate sensor is adapted to detect a flow rate of the fluid flowing in said sensor tube based on variations of voltages applied to said pair of heating resistors, the variations occurring according to the flow-rate of the fluid.

2. (Original) A flow rate sensor as claimed in claim 1, wherein the increase in temperature of each of said pair of heating resistors is 5.degree. C. or less than a temperature of said temperature sensor.

3. (Original) A flow rate sensor as claimed in claim 1, wherein said sensor tube has a U-shaped configuration.

4. (Original) A flow rate sensor as claimed in claim 3, wherein said tube guide comprises an upper case and a lower case, each of said upper and said lower cases having a U-shaped groove for containing the U-shaped sensor tube, and said upper and said lower cases being connected together via screws.

5. (Original) A flow rate sensor as claimed in claim 1, wherein said sensor tube guide is made of a material having a high heat conductivity.

6. (Original) A flow rate sensor as claimed in claim 1, wherein said sensor tube guide encloses the sensor tube and is removably provided in said case.

7. (Original) A flow rate sensor as claimed in claim 1, wherein said pair of heating resistors comprise metallic thin films.

8. (Original) A flow rate sensor as claimed in claim 1, wherein said case comprises an upper case and a lower case, wherein said upper case and said lower case are fixedly connected to each other via screws.

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9. (Currently amended) A flow rate sensor for detecting a flow rate of a fluid, the flow rate sensor comprising:

a sensor tube operable to allow a fluid to flow therein;

a plurality of inner tubes provided within the sensor tube;

heating resistors operatively connected attached to the sensor tube, for heating the sensor tube;

a temperature sensor operable to control temperatures of the heating resistors; and

a voltage applying device operable to set an increase in temperature of each of the pair of heating resistors;

wherein the flow rate sensor is adapted to detect a flow rate of the fluid flowing in the sensor tube based on variations of voltages applied to the pair of heating resistors, the variations occurring according to the flow rate of the fluid.

10. (Original) A flow rate sensor as claimed in claim 9, wherein the sensor tube has a U-shaped configuration.

12. (Original) A flow rate sensor as claimed in claim 9, wherein the sensor tube is made of stainless steel.

13. (Original) A flow rate sensor as claimed in claim 9, wherein the sensor tube has an outer diameter of 4 mm and an inner diameter of 3 mm.

14. (Original) A flow rate sensor as claimed in claim 9, wherein the inner tubes are made of stainless steel.

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15. (Original) A flow rate sensor as claimed in claim 9, wherein the inner tubes each have an outer diameter of 1.0 mm and an inner diameter of 0.8 mm.

16. (Original) A flow rate sensor as claimed in claim 9, wherein the inner tubes are provided within the sensor tube, such that respective outer wall surfaces of the inner tubes are in contact with each other.

17. (Original) A flow rate sensor as claimed in claim 9, wherein the inner tubes are provided within the sensor tube, such that respective outer wall surfaces of the inner tubes are in contact with the sensor tube.

18. (Original) A flow rate sensor as claimed in claim 9, comprising three of the inner tubes within the sensor tube.

19. (Original) A flow rate sensor as claimed in claim 9, wherein the heating resistors comprise metallic thin films.

20. (Original) A flow rate sensor as claimed in claim 9, wherein the heating resistors comprise a wire having an outer diameter of 30 microns and a resistance of about 0.5 Ω /mm, and the length of the wire is determined so that each of the heating resistors has a resistance of about 1,000 Ω .

21. (New) A flow rate sensor as claimed in claim 9, and further including a bypass tube connected in parallel with the sensor tube.